

Remarks

The following is in response to the Office Action dated June 27, 2006 in which pending claims 1, 3-4 and 6-13 were rejected under 35 U.S.C. 103(a) as being unpatentable over O'Connor et al. (US 5,648,767).

As a follow-up to the telephone conversations the undersigned had with the examiner on August 1 and 2, 2006, the independent claims 1, 6 and 13 each have been amended to recite that the claimed ETC (Electronic Toll Collection) system consists of the recited components. Thus, with reference to claim 1 for example, the claimed ETC system has one antenna that has a predetermined directivity to provide a limited radio communication service zone that extends from the antenna and covers at least a portion of the area of a lane under the antenna, the length along the lane being set to a distance that is approximate to a single vehicle. The claimed ETC system further includes only one single vehicle sensor that is positioned within the service zone at a location closer to the on coming vehicles than the antenna by a predetermined interval to allow it to detect a vehicle that has reached a predetermined position defined in the limited radio communication service zone, with the predetermined position being defined by the location of the vehicle sensor such that only one vehicle within the service zone is sensed by the vehicle sensor at one time.

By having only one antenna and one vehicle sensor, the inventive system is able to be constructed efficiently and at a lesser cost than the prior art systems, as well as requires less computational power than those system that require multiple antennas and detectors such as the prior art O'Connor system.

To elaborate, O'Connor discloses a system for detecting the transponder of a vehicle that reaches an "arming loop" detector 24 (shown as a plate onto which a car rolls over) along a toll lane. To achieve this, O'Connor relies on the use of a phase mono-pulse technique that uses the "boresight" of respective antennas to focus onto an area where a vehicle, with or without a transponder, would arrive. Each antenna to be used in the

O'Connor system has to have at least two elements to establish a spacing D based on the phase shift between the elements, which may be $\lambda/2$ or 180° , for defining the direction of the angle of arrival of the signal (Column 3, line 40 to column 4, line 12). The operation of the exemplar embodiment in which two antennas are used is disclosed in column 4, lines 66 to column 5, line 34.

As shown in the Fig. 4 embodiment and disclosed in column 5, line 35 to column 6, line 4, two sensors 24 and 28 (both plates) are provided on the toll lane, with sensor 24 being an arming loop sensor and sensor 28 being a clearing loop sensor. Further, the antennas 32 and 34 shown in the Fig. 4 embodiment are focused to an area of interest on the road that is sensor 24.

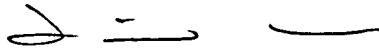
Thus, it is clear that for the O'Connor system requires that there be multiple antennas and/or multiple antenna element arrays, as shown in Fig. 10, for effecting a boresite onto the incoming vehicle. Thus, the use of a single antenna having a predetermine directivity simply would not work for the O'Connor system which requires that there be at least two element arrays in order to effect a phase mono-pulse technique to detect the transponders that are on the "boresite" of the antenna array. Having to use multiple antennas and/or multiple antenna array elements, not to mention multiple sensors, means that the O'Connor system is more expensive to construct than the instant inventive system. Moreover, the fact that the different antennas need to be directed at respective particular angles, such as that shown in Fig. 4, means that the angle at which the antennas are placed needs to be carefully made and adjusted, which would entail additional cost. The single antenna of the instant invention does not require such fine tuning, as the antenna itself provides the limited radio-communication service zone that covers a portion of the car lane under the antenna.

In view of the foregoing, applicant respectfully submits that the instant invention is patentably distinguishable over the prior art. Accordingly, the examiner is respectfully

requested to enter the Amendment, reconsider the application and the pass the same to issue at an early date.

If the examiner has any suggestion for expediting the prosecution of this case, she is respectfully requested to contact the undersigned.

Respectfully submitted,



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